Register Number:……..

KUMARAGURU
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M.E / M.TECH DEGREE EXAMINATIONS: NOV/ DEC 2024

(Regulation 2024)

First Semester

EMBEDDED SYSTEMS TECHNOLOGIES

24ETI502: Microcontroller Based System Design

COURSE OUTCOMES

CO1: Understand the architectural features of PIC Microcontroller.

CO2: Apply the techniques to control PIC peripherals using Embedded C programming.

CO3: Understand the fundamentals of ARM processor.

CO4: Apply the instructions to control ARM peripherals using Embedded C programming.

CO5: Analyze the I/O hardware interface of PIC & ARM for consumer application with peripherals.

Time: Three Hours **Maximum Marks: 100**

PART A (4*20 = 80 Marks)

1.	a)	Make use of UART communication system on a microcontroller to transmit and receive the string for a specific baud rate, data frame, and parity.	6	CO4	[K_3]
	b)	Interpret the interrupt handling schemes in ARM processor. Scenario: You need to optimize a program for an ARM-based microcontroller to perform arithmetic and logic operations efficiently.	6	CO4	[K_2]
	c)	How does the Thumb instruction set achieve reduced code size compared to the ARM instruction set?	4	CO4	[K_2]
	d)	Write a program using ARM7 instructions for the C statement x=a+b-c; implement by using registers r0 for a, r1 for b, r2 for c, r3 for x and r4 as indirect addressing register	4	CO4	[K_3]
2.	a)	Compare Von Neumann and Harvard architectures in terms of speed and complexity.	4	CO1	[K2]
	b)	Illustrate how memory is organized in a PIC microcontroller and explain the purpose of different memory types within the architecture.	6	CO1	[K2]
	c)	Outline the different addressing modes supported by PIC	5	CO1	[K2]

	d)	Explain the role of timers in PIC microcontroller and give the difference between a timer and a counter.	5	CO1	[K2]
3.	a)	Illustrate the internal architecture of an I2C module with a labeled diagram. Explain the function of its key components	4	CO2	[K2]
	b)	How does SPI differ from I2C in terms of speed and complexity?	3	CO2	[K_2]
	c)	Write a program to generate a sine wave output using a D/A converter using PIC microcontroller.	5	CO2	[K_3]
	d)	Examine the operation of a CCP module configured in PWM mode. Analyze how the selection of parameters such as duty cycle and frequency impacts the performance of an application.	4	CO2	[K_3]
	e)	Design a program using a PIC microcontroller to display the current temperature reading from a sensor on a 16x2 LCD. Apply the concepts of initialization, data writing, and cursor control to implement the solution.	4	CO2	[K3]
4.	a)	Interpret ARM7 architecture with various operating modes and its associated registers with neat sketch.	7	CO3	[K_2]
	b)	Explain the role of interrupts in an ARM-based embedded system, and demonstrate how an interrupt-driven approach can be used to handle multiple concurrent events.	4	CO3	[K_2]
	c)	Infer the use of a coprocessor in ARM to handle specific tasks in a system with limited processing power.	4	CO3	[K_2]
	d)	Given a set of operations on data stored in registers and memory, classify the addressing modes of ARM to achieve the most efficient data access in a microcontroller-based system.	5	CO3	[K_2]

Answer any ONE Question
PART B (1*20 = 20 Marks)

5.	a)	Compare the project management features of MPLAB and KEIL IDEs and analyze their impact on the development workflow for embedded systems.	6	CO5	[K4]
	b)	Analyze the challenges in designing an RTC system using I2C communication, focusing on factors such as clock accuracy, power consumption, and data integrity during power outages. Propose strategies to mitigate these challenges and ensure reliable timekeeping.	7	CO5	[K_4]
	c)	Design ADC using PIC microcontroller and evaluate the impact of noise on	7	CO5	[K_4]

ADC data transmitted via I2C and propose strategies for minimizing errors.

OR

6.	a)	Analyze the efficiency of Hamming Code implementation on an ARM microcontroller for error detection and correction in high-speed data transmission.	6	CO5	[K_4]
	b)	Analyze the design considerations for implementing a frequency counter using an ARM microcontroller with an LCD display. Evaluate the impact of timer configuration, signal conditioning, and LCD update rate on the accuracy and real-time performance of the system	7	CO5	[K_4]
	c)	Design an ARM-based digital multimeter and evaluate the challenges of integrating multiple measurement functions in a single multimeter.	7	CO5	[K4]

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